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Editorials.

A NEW APPLICATION OF THE STOMACH TUBE FOR DIAGNOSIS.

THANKS largely to the perseverance of Mr. M. W. Lang, M.R.C.V.S., who has devoted much time and thought to the subject and given demonstrations before numerous societies, the use of the stomach tube has now become general in the hands of a number of practitioners, and its utility in certain classes of case cannot be denied. In the present issue, however, further pioneer work is reported from India in its use as a diagnostic agent for certain parasites of the stomach—in this case for the early diagnosis of *Habronemiasis*, and we cannot but congratulate Major R. Hodgkins, D.S.O., M.R.C.V.S., on the happy thought which led him to try an idea which has been followed by such good results. In a disease of this kind, early diagnosis is of the utmost value, and, as the method is a simple one and quite easy to apply, we are sure that it will be much appreciated and followed out, not only by our British colleagues, but also by our Continental *confrères* when practising in colonies which have in them patients suffering from this troublesome infection of the horse.

OUR POST-MORTEM OPPORTUNITIES.

RECENTLY some striking headlines have appeared in certain sections of the public press asserting that mistakes of diagnosis occur in human medical practice in as high a proportion as 80 per cent., and that the remedy lies in the right of the doctor to demand a post-mortem examination. The proportion is exaggerated, but that mistakes of diagnosis do occur is a fact which is only too obvious even to the man in the street, especially since the panel system has come into vogue. To be proud of having disposed of so many patients in an hour denotes a want of care in diagnosis which is eventually going to reflect unfavourably on the health of the nation, and it is questionable whether those who run this class of practice would look with favour upon the idea of universal *post-mortems*. To the real student, however, and every medical man *should* be a student all his life, the opportunity of a *post-mortem* would be snatched at eagerly as a means of acquiring knowledge. Similarly with our profession; when we take the trouble to *post-mortem* an interesting case—how often do we find a condition of affairs which totally contradicts the diagnosis made in life? *Post-mortems* are educations in themselves, and we in the Veterinary profession have, in the facility with which we can obtain them on our patients, a very great advantage over our medical *confrères*. Alas, how few of us make use of our opportunities in this direction!

THE COMPARATIVE ASPECT OF ACTINOMYCOSIS.

IN another column we publish an abstract of a paper which has recently been published in the *Lancet* on the treatment of Actinomycosis in human patients, and it is interesting to be again reminded of the fact that the treatment by the administration of iodide of potassium internally does not meet with the high proportion of success in man which accompanies its use in the treatment of this disease in cattle. The author advocates surgical measures, accompanied by the injection of a vaccine, and it may be worth while to consider this method of application to those of our patients who do not respond to potassium iodide. The proportion of these is not high, but every now and again the practitioner meets with such cases, and occasionally in a pedigree beast of great value. The paper is well worth perusal, even if only looked upon from the comparative aspect, as showing the respective varieties of method adopted by the human and the veterinary surgeons for the treatment of a disease which has a common origin in man and animals.

General Articles.

THE PREVENTION OF TUBERCULOSIS IN CATTLE.

By NATHAN RAW, C.M.G., M.D., M.P.,
(*President of the Tuberculosis Society of Great Britain and Ireland.*)

One of the most urgent problems of the day is, undoubtedly, the eradication of tuberculosis from dairy cows.

Not only from the point of view of having healthy, tubercle-free cattle, but on account of the immense influence on public health.

It is now settled beyond all doubt that a very large amount of tuberculosis is conveyed to children and young adults by means of milk from cows suffering from tuberculosis of the udder, and how much is conveyed by meat, butter, and cheese is not yet definitely determined.

It is estimated that a million dairy cows in Great Britain are at present affected with tuberculosis, of which about 5 per cent. are affected in the udder, rendering these cows extremely dangerous to the public health.

If all these cattle were destroyed to-morrow, and full compensation given to the owners, it would not solve the problem, as another generation of calves is coming on, many of them already infected, either by living in contact with their mothers, or infected in the early weeks or months of life by drinking the milk of a tuberculous cow.

The only solution to the problem is *prevention of infection.*

It cannot be too strongly emphasised that calves are born healthy and quite free from tuberculosis. They may easily be infected if not separated from diseased animals, or if they are fed with milk containing tubercle bacilli.

The only cause of this disease is the tubercle bacillus, and it is invariably conveyed either to man or animals from without, viz., by Inhalation, Ingestion, or Wounds of the skin.

We recognise three types of tubercle bacilli, all originally of a common species, and, developing from a long residence in certain animals or man, certain characteristics which they have retained:

1. Human.
2. Bovine.
3. Avian.

The Human Type causes pulmonary tuberculosis or consumption in man, and is not easily conveyable to cattle.

The Bovine Type attacks cattle, pigs, and horses, but very rarely sheep or goats, and never dogs.

The Avian Type attacks birds, poultry and fishes.

The Avian type cannot be conveyed either to animals or man, and, therefore, can be disregarded so far as causing the disease in the human

is concerned, but the Bovine type is easily conveyable both to animals and man, and is, therefore, a great danger to the public.

For this reason it is imperative to do all in our power to eradicate the disease from dairy cows, if we are to prevent a never-ending supply of tuberculosis from animals to man.

An enormous amount of work has been done all over the world in the attempt to immunise cattle against tuberculosis.

Von Behring inoculated a large number of cattle with human bacilli and produced an immunity lasting from six months to a year, but this work was not conclusive.

Bang, of Copenhagen, believed in strict segregation, and Nocard did a lot of work on the same lines. Calmette, of Lille, has just published a record of cases in cattle in which he shows the possibility of immunising young cattle by injections of bovine bacilli.

I came to the conclusion in 1906 that we could not expect to get good results either in immunity or in the treatment of the disease by using virulent bacilli, and for that reason I decided to attempt to alternate the bacilli, so as to render them safe for use by long continued subculture.

The only certain way of permanently attenuating virulent cultures of tubercle bacilli is by long-continued and systematic subculturing spread over a number of years.

In 1906 Professor Koch gave me in Berlin a pure culture on glycerine agar of human bacilli from the sputum of an advanced case of pulmonary tuberculosis. Professor Calmette supplied me with a pure culture of bovine tuberculosis obtained from the mesenteric glands of a cow, and Professor Bang, of Copenhagen, gave me a pure culture of Avian bacilli from the liver of a chicken.

These cultures have been subcultured on glycerin potato and then transferred to glycerine agar every month for fifteen years in my laboratory, and the present growths represent the 184th generation.

The growths are still profuse and true to type, but they are quite non-tuberculogenic and completely non-pathogenic to animals.

Every year since 1906 I have injected these bacilli into animals with a view to testing their pathogenicity. Until the year 1912, that is the 84th generation of subcultures, I noticed no change in their virulence. After that time attenuation became marked, and in a series of animal inoculations of these bacilli in 1913 and 1914, they were observed to be avirulent.

These experiments, which have occupied me for fifteen years, conclusively prove that virulent tubercle bacilli can be attenuated to such a degree as to be avirulent and non-pathogenic to highly susceptible animals, and, in my opinion, we have in our hands a remedy

against tuberculosis which will be of the greatest value, not only in the cure of the disease, but what is of still greater importance, in its prevention, by protecting the animal against infection.

If we can produce some immunity by artificial means, either in man or animals, sufficient to enable them to resist infection, we will have gone a long way towards stamping out tuberculosis.

The vaccine which I have prepared from these attenuated cultures is a bacillary emulsion of the bacilli and contains all the products of the bacillus. Living cultures are not used for this purpose.

For the purpose of immunising calves, they should be separated from the mother at birth, and fed on healthy milk or the pasteurised milk of the mother for a week, when the first dose of vaccine is given, followed in another two weeks by the second dose of vaccine.

The vaccine is given hypodermically in the usual way with strict aseptic precautions, under the skin of the abdomen.

It may be possible to use the vaccine for the purpose of treating those animals already infected, but of this I have no experience, and it cannot be too strongly emphasised that the treatment I advocate is only of value in non-infected animals.

The question is of such immense importance to the rising generation of children that it is our duty to adopt every means possible to stamp out tuberculosis in cattle.

BACILLUS COLI INFECTIONS IN THE NEW-BORN FOAL.

By S. H. GAIGER, F.R.C.V.S.,
and
THOS. DALLING, M.R.C.V.S.,
(*Animal Diseases Research Laboratory, Glasgow Veterinary College.*)

THE following cases are placed upon record together with a discussion upon them in the hope of guiding practitioners along these lines of observation, and inducing them to record how far these ideas fit in with what they constantly meet in practice.

I.

The mare, a Clydesdale mare, was at one time a prize winner. She had her first foal in 1912 and had had in all eight foals numbered (1) to (8) below. Her dam, still alive, has had eight foals but none of those became affected with joint-ill.

Foal (1) when born, lay for twelve days, sleeping most of the time, and was not expected to live. On several occasions it seemed dead when disturbed to receive its small regular diets of milk. There was no abnormality about the legs. The foal recovered, never showed lameness and lived a number of years.

Foal (2) was born in April. It died in 24 hours. There was no abnormality of the joints. It had sucked well in the first hours of its life.

Foal (3) was born in April. It died at three months old. It never showed any lameness. It was affected with scour from the age of one month. It was treated, but without avail.

Foal (4) lived. Was sold as a gelding later.

Foal (5) was born in March. It had scour for three days when ten days old. Recovered and took prizes.

Foal (6) was born in April ; never had a day's illness, recovered and took prizes.

Foal (7) was born in March. It died at the age of three weeks. It suffered from indigestion and scour for seven days, when the joints and limbs became swollen and the foal went lame. The navel was properly healed. It was treated for scour without success. Treated for joint-ill with antistreptococcic vaccine but without improvement.

Of the above seven foals five were fillies and two were colts.

Foal (8) was the only one dealt with at this Institution. The foal was due on March 24 but was born on April 10 at 11 p.m. It was a foal of immense size and great quality. When born it lay and groaned for about two hours before it got on its feet, when apparently it became all right and was quite lively. It would not lay hold of the teats and suck properly, though it seemed a strong foal and was making plenty of vigorous efforts to suck. The foal was taught to suck upon the evening of April 11, at which time it was perfectly normal and showed no signs of lameness. The temperature was 101.2, pulse 120. The navel string was normal and tied. The foal was housed in a scrupulously clean large loose-box, specially prepared, and treated with lime and carbolic acid. Half an ounce of castor oil was given at 8 p.m.

On April 12, at 3.30 a.m. the foal was seen by the owner. It was all right and frisking round the loose-box. At 5 a.m. the foal was noticed lame, the near-hind fetlock was badly swollen, and by noon both fore fetlocks similarly affected, then, an hour later, both knees. The fetlock joints were very painful to the touch, the foal lay most of the time groaning, and seemed in great agony before death, which occurred at 2 p.m. on April 12.

The limbs were removed at once and sent to the College.

The mare at this period showed no sign of any ailment. She was always a heavy milker.

Bacteriological Study.—All four limbs were received for examination. All the joints were purulent, and the pus was thick, though able to run, in all joints, except in the hock, where it is better described as purulent synovia. The tendon sheaths were also purulent.

The pus contained large numbers of short bacilli, varying somewhat in length. The shortest forms were almost coccoid, the longest forms reminded one of the pathogenic anaerobes in so far as size went, while

many of the organisms showed up much more deeply stained at their ends. Very large numbers of the organisms, including all the forms mentioned, were inside phagocytes, one might almost say the majority were phagocytosed. Long experience of work with bacilli of the coli type enabled one to venture a confident opinion that cultural work would yield pure cultures of the coli type.

An excellent growth was obtained in 24 hours on agar, blood-agar, and bouillon, and also in anaerobic culture, and on plate cultures. In all cultures the organism was pure and was of the coli type, morphologically and culturally. It was gram negative, motile, with the characteristic coli-motility. Gelatin was not liquefied.

Fermented.	*Did not Ferment.*
Glucose.	Saccharose.
Lactose.	Dulcite.
Mannite.	Adonite.
	Inulin.

In litmus milk there was, up to three days, formation of acid but no clot. Cultures were shewn to be pure by plating out. They were tested for sporulating anaerobes by heating three-day anaerobic cultures, but no anaerobes were found to be present.

It was concluded that this case was one of pure coli infection.

Pathogenicity of culture.—A rabbit was inoculated intra-peritoneally with 5 cc. 24-hours' first subculture, but without fatal effect. The rabbit was dull and off its food for a few days and then recovered.

Test of the mare's milk.—The milk was withdrawn with aseptic precautions and a pipette inoculated on to agar plates, but no growth resulted on inoculation.

The owner was unwilling to have the mare's blood withdrawn for the agglutination test with the foal's bacillus.

II.

In this case the same amount of particulars were not forthcoming.

As in I the foal would have been a valuable one. The mare was the mother of at least one prize winner.

The foal was born at 9 o'clock on a certain day in April and died 47 hours later. It was "weakly" to begin with, and did not suck till 15 hours after birth. It only took three or four other drinks altogether, went down and became unable to rise, began groaning from pain and died.

Sent whole to the College for examination.

Post-mortem examination.—The stomach showed acute gastritis. The liver was in a state of cloudy swelling. None of the joints contained thick pus, but a gummy synovia which was very cloudy and in excess.

Bacteriological work.—One stifle joint, one hock, and two fetlocks, all on different limbs were dealt with. Cultures were made aerobically on agar and blood agar, and on anaerobic media. Smears were made in each instance.

The microscopical examination gave identical appearances to those described in I, phagocytosis being pronounced, as before.

Cultural work.—Pure growth in all the tubes of B. coli. Motility of organism more marked than in I. Plate culture did not reveal any impurity aerobically. No sporulating anaerobe found on heating 3-day anaerobic cultures and subculturing.

Did not liquefy gelatin.

Litmus milk, in three days, acid and no clot.

Fermented.	*Did not Ferment.*
Glucose.	Saccharose.
Lactose.	Dulcite.
Mannite.	Adonite.
	Inulin.

Concluded this foal died from a pure coli infection.

Pathogenicity of culture.—A rabbit was inoculated intraperitoneally with 5 cc. 24-hours' primary culture of B. coli from one of the joints mentioned, on March 26. It died on May 17. There was a local ulcer where the needle passed in. The subcutaneous tissues were much discoloured and there was a purulent lymphatic vessel leading from a purulent lymph gland in the right groin. The pus was very thick and white, and swarming with organisms of the coli type. The liver was much enlarged and smears revealed an amazing number of colon bacilli. The blood, too, was swarming with the same organism. Cultures were pure B. coli.

Blood from the mare was asked for and a sterile bottle provided, but only two drops were sent, insufficient to test the agglutinative power of her serum upon the foal's organism.

Test of the mare's milk.—The milk was drawn into a sterile bottle. It yielded no growth of B. coli, but some colonies of staphylococci, which organisms probably gained entrance when the milk was drawn.

III.

The mare was newly purchased and no history of her previous foals was forthcoming.

The foal was not sent to the College as a joint-ill case, but merely with a request for an opinion on the cause of death.

The foal was born in May. It died when 24 hours old. The *post-mortem* examination was made the following day, but the carcase was in a surprising state of decomposition.

Post-mortem examination.—Externally there was nothing abnormal.

The joints, on opening, showed nothing abnormal, there being a quite normal amount of synovia present.

The peritoneal fluid was in excess and tinted with hæmoglobin.

The liver was much enlarged, dark in colour and very friable.

The spleen was dark and petechiated.

The kidneys were in a state of cloudy swelling and showed ecchymoses.

The villous portion of the stomach was acutely inflamed.

The lungs were inflamed and showing ecchymoses.

The serous membranes were ecchymosed.

There was hæmorrhagic endocarditis.

The endothelium of the vessels was bloodstained.

Microscopical examination of smears from the liver tissue showed short bacilli with all the appearances of the colon bacilli described in I, and phagocytosed in enormous numbers by polymorphonuclear leucocytes. There were numbers of organisms of the Vibrion septique type, these not being phagocytosed.

Examination of the mare's milk.—Along with the foal, the practitioner sent a sample of the mare's milk properly collected in a sterile bottle with the information that the mammary gland was indurated. This " milk " was of the appearance of cloudy gum and was so thick it would not run out of the bottle.

Agar and blood-agar tubes were inoculated. Agar yielded no growth. Blood agar yielded several colonies like streptococcus growths. These grew well in subculture on agar and blood agar and formed long chains of streptococci in blood bouillon.

A rabbit was inoculated subcutaneously with 2.5 cc. 24-hours' blood bouillon culture of this streptococcus, on May 6, 1921, and was dead on May 7. Death was due to a septicæmic infection.

Mare's serum properly drawn in a sterile bottle from the jugular vein was tested upon the colon organism of II, but without agglutinating it.

Vaginal swab from mare properly taken with a speculum did not give a coli growth but only Staphylococcus pyogenes aureus and albus.

IV.

This case was seen while visiting a practitioner in the east of Scotland. The foal died at the moment of our arrival at the farm and was dealt with immediately.

The mare gave birth to this, its first foal, at 9 p.m. on a certain day in May.

The foal died 41 hours after birth.

It did not suck at all the first night. When taught to suck it only played with the teat and took nothing. It was not noticed to be lame.

It was never able to lie down properly, although a strong foal, and always let itself fall over on its side in order to lie down.

The carcase was dealt with immediately.

Post-mortem examination.—Liver much enlarged. Peritoneal cavity, organs, and bowels, normal. The stomach normal in appearance from the peritoneal surface, but showing bright red inflammation of the mucous membrane on being opened. Chest cavity normal.

No sign of joint lesions in the uncut limbs. Two fore-limbs were removed and dealt with bacteriologically the same evening. A portion of liver was taken in a sterile tube.

Bacteriological work.—There was a considerable amount of thick, purulent synovia in one knee and in the tendon sheaths of the other leg in the fetlock region.

Smears from this synovia showed the appearances described in I, phagocytosed bacilli predominating.

Cultures were made aerobically on agar, blood agar and bouillon and on anaerobic media from the purulent synovia and from the liver.

All cultures were positive, the B. coli growing in pure culture. Tests as before showed the organism to be pure aerobically and to be free of sporulating anaerobes.

As before, all the well-known reactions of the B. coli were given, but there was a variation in the sugar fermentation results in this instance.

Fermented.	*Did not Ferment.*
Glucose.	Inosite.
Lactose.	
Saccharose.	
Mannite.	
Dulcite.	
Adonite.	
Sorbite.	
Inulin.	

Litmus milk clotted in 24 hours.

Conversations with practitioners from different parts of the country show that all of them have had a number of cases of foals dying within the first three days after birth from symptoms such as have been described above, and that where post-mortem examinations have been made no kidney lesions have been found as would be the case with a B. nephritidis equi infection.

It is interesting to note in I, above, that of the mare's eight foals only four lived. Of the four which died, two died very shortly after birth—one in 24 hours and one in 38 hours,— the third became affected with scour when two weeks old and died at the age of three weeks, the fourth became affected with scour at one month old and died at the age of three months. Of the four which lived one had some kind of toxic infection from birth till 12 days old, was well

cared for and recovered ; the second had scour from the seventh day but recovered ; the other two were reared without trouble. Only two out of eight foals really escaped infection. The scours from which the foals suffered were spoken of as " white scours." It is not taking too much for granted, in view of what we now know of such infections, to assume that the scour conditions were due to the action of the colon bacillus. In all the six foals only two would have been termed " joint-ill " cases by the owner or practitioner. It is reasonable to conclude that this mare is a carrier of a particularly virulent strain of colon organism. If the foal receives this organism during birth or as soon as born, death may occur in a day or two—Foals (2) and (8), or a septicæmic condition may result in recovery—Foal (1). If the foal becomes affected at a week old—Foal (7), the course of the affection is not so acute and scour may set in, with death at the age of three weeks, or recovery as in Foal (5), or if infection takes place at a month old—Foal (3), the resulting scour may not kill till the foal is three months old. Infection may not take place at all—Foals (4) and (6).

Where does the mare carry infection ? It must be either in the milk, or the uterus and vagina, or the intestine and fæces. The milk of the mare in I, II, and III was shown not to harbour the B. coli. A colon organism of such virulence could hardly be present in the uterus of a pregnant mare without causing abortion from metritis, and probably the presence of the organism high up the vaginal passage would lead to a similar result. The writers have shown in the case of lamb dysentery that the causal organism—a bacillus of the coli type—can be carried in the intestine of the ewe. It would appear then as if the colon organism, which sets up the disease in foals, is probably carried in the intestine of the mare. The bacillus could be obtained by the foal from the vulval region during birth. Foals make swallowing and sucking movements during birth before they have breathed. They may also get the infection from the external parts of the mammary gland and teats.

What might be done to prevent infection ? This raises the much-discussed question of the respective merits of treatment of the mare and treatment of the foal, also serum treatment for either or both, or vaccine treatment for either or both, or serum and vaccine treatment for either or both. In the writer's view, the line of treatment should depend upon whether the mare is in her first pregnancy or a subsequent one. One should aim at having the foal born with as much immunity as possible.

If the foal is to be the mare's first one, it is obvious that the practitioner cannot know whether the foal, which is a valuable one and must have everything possible done to save it, is likely to contract a

streptococcic or a coli infection (leaving B. nephritidis equi out of account). Shall the practitioner inoculate the pregnant mare, and, if so, what shall he inject ? In our opinion inoculation of the pregnant mare must aid in preventing infection of the foal by causing it to be born with a certain amount of immunity, and that this can be taken advantage of and quickly strengthened by further inoculations when the foal is born. We do not advocate inoculation of the pregnant mare to prevent intra-uterine infection because we do not think that this occurs, except in a small proportion of cases and probably not in any caused by B. coli, the streptococcus, or B. nephritidis equi.

Whichever the injection is it must be from a coli and a streptococci source. It should be a vaccine, and it must be a mixed vaccine from organisms obtained from a number of such infections in foals. One dose will hardly be sufficient. The writers would suggest not less than two doses, and preferably three doses at two months to one month before the foal is expected. If a serum is to be used upon the mare, it must be anti-coli as well as anti-streptococcic. The difficulty is to judge when the serum dose should be given. The ideal would be to give it a few days before the birth of the foal. One might be lucky and just hit this off, but in many cases one would not have this luck. Every extra day after the third or fourth would mean that more serum would be eliminated and protection be lessened. Of course one could give a dose of serum every few days after the first dose until parturition, but that adds to expense. The dose of serum must necessarily be a very large one because the foal can only get a fraction of the antibodies injected into the mare, the rest being distributed in the mare's system where it is not required.

Immunity of the foal derived from its mother can only be of a passive nature and therefore does not last long, so that as soon as the foal is born it should receive anti-coli and anti-streptococcic serum injected simultaneously with vaccine from the B. coli and the streptococcus, followed a week later by mixed vaccine alone.

A similar course would be pursued in mares at their second or third, etc., pregnancies, provided the previous foal or foals had remained healthy.

If a mare has had a foal with a septicæmic or joint infection the practitioner should do his best to decide what the nature of the infection is. The best method of doing this is to send a leg from the dead foal to a laboratory for examination. He should impress upon the owner that the foal will probably die, and that the moment it does so a fore-limb is to be removed between knee and elbow and despatched *at once* so as to arrive at the laboratory in as short a time as possible. By doing this, cultures can be obtained to vaccinate the mare during her

next pregnancy and so protect the next foal against a like thing happening again. This is the nearest thing which can be done to having an autogenous vaccine for the next foal's benefit. Failing this, the practitioner should make a thorough post-mortem examination and try to decide for himself what the nature of the causal organism is, remembering the following points :—

Bacillus coli.—Foal taken ill a day or two after birth and dead in a matter of 24 or 36 hours. Clinically a septicæmia. The lining membrane of the stomach shows a bright red inflammation showing where infection originated.

The liver is enlarged and friable. The navel is probably quite normal. Joints may or may not show enlargements. Synovia cloudy or purulent. Otherwise the cause of death may be from scour.

B. nephritidis equi.—Foal taken ill a day or two after birth and dead in a matter of 24 or 36 hours. Clinically a septicæmia. In the kidneys are found diagnostic lesions. Kidneys enlarged, filled with blood, capsules easily stripped. On section the glomeruli show as small purulent spots in the cortex only just visible to the naked eye or $\frac{1}{8}''$ in diameter. The liver may be enlarged. Navel probably quite normal. Joints may or may not show enlargements, depending on how long the foal lives. Synovia purulent or discoloured.

Streptococcus.—Taken ill when aged twelve days or more and died after a comparatively long illness of perhaps three weeks. Joint lesions more advanced and extensive owing to longer survival. Navel may be still unhealed.

Having made up his mind as to the cause of death in the foal, the practitioner can make his own decision as to what vaccine he will use on the mare during her next pregnancy, and vaccine and serum on the foal in accordance with the plan already outlined.

In the case under III, above, death was probably due to a double infection of B. coli and the Vibrion septique, the latter having penetrated from the stomach along with the former, the additional lesions being due to the Vibrion septique. It was, in this instance, not a case of post-mortem invasion and decomposition one was dealing with.

It will be noticed in I and II that the fermentation reactions are exactly similar, whereas in IV these reactions were different. The occurrence of such a close similarity between the organisms of I and II may suggest to some that perhaps their agglutination reactions might be identical, and that the agglutination test could be used to show whether a pregnant mare is a carrier of a virulent type of colon bacillus or not. By such a means it might have been possible to detect and treat mares whose foals would be especially liable to infection. In the case of coli infections it is highly improbable that such a test would

give results of any value, for, as has been shown by Mackie, however closely strains of B. coli may resemble one another in fermentation and other tests, the serum from any particular strain is very highly specific for that strain in agglutination and complement fixation.

The writers are of opinion that if practitioners would work upon these lines, a great deal more success would attend their efforts against infection in young foals. Practitioners might do more than they do in recording the histories of the sire and dam in such cases. Why, for instance, are the foals of certain stallions so liable to such infections ?

Everything depends upon a knowledge of which bacterium is at work. Much discredit has fallen upon anti-streptococcic serum because it has been used to try and save foals suffering from a pure coli infection. Bear in mind that human beings can be successfully vaccinated against typhoid, dysentery, cholera, and plague all in the same syringe. Do not expect the effect of a serum to last more than ten days. It is unfortunately true that a serum or vaccine may too often be itself to blame. Till we have a reliable serum institute in this country for such purposes we cannot expect it otherwise.

Those who believe that serum and vaccines in such cases are to be disregarded in favour of treatment of the umbilical cord, offer no opinion as to how coli infections via the mouth are to be combated, though perhaps 25 per cent. of such cases are of that nature.

Our thanks are due to Mr. Walter Gardner, M.R.C.V.S., for his care in collecting details in connection with the mare and foals described under I.

SOME OF THE USES OF FORMALIN.

By DAVID IMRIE. M.R.C.V.S.
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THESE remarks are largely the outcome of a number of inquiries and requests for further information regarding the therapeutic use of formalin received since the appearance of Mr. Lang's article in a recent issue of the VETERINARY JOURNAL. Formalin has for a long period been employed by the writer in the treatment of a few diseases with satisfactory results, but since the adoption of the stomach tube method of administration about eighteen months ago, it has been possible to give much larger doses in sufficient dilution, and its employment has been greatly extended.

Actions and Uses.—It is an antiseptic, a disinfectant, a deodorant, but a strong irritant, and when given internally it must be largely diluted. It appears to stimulate the secretions of the gastro-intestinal tract slightly with laxative results, and is employed in cases where an internal antiseptic is indicated—*e.g.*, disorders and diseases of the

alimentary canal, toxæmia due to absorption of toxins from the alimentary tract, or from suppurating foci in the bowel or some other part of the body.

Dose.—Two drachms to one ounce may be repeated two or three times a day. The smaller dose may be given orally in the form of a drench; intravenously in ten ounces of water at blood heat—care being taken to prevent any of the solution reaching the subcutaneous connective tissues—or mixed with the food. The larger dose should be given by the stomach tube.

Formalin is often combined with other agents, such as normal saline solution, nux vomica, and chloral hydrate. The satisfactory results obtained from its use are in some instances probably due in great part to the substances with which it is combined.

Externally.—It is employed in dilution to meet the case, and has been found a safe, efficient, and economical dressing for wounds of all kinds; helpful in the treatment of canker of the horse's foot, conjunctivitis, ulcerative keratitis, as an irrigation for operation wounds, as a dressing for removal of foreign bodies embedded in exudate on the cornea, for injecting into the viscus after liberation of the gas in tympany of the rumen and of the bowel.

Colic.—Noting the satisfactory, if not salutary effect of large doses of normal saline solution administered per stomach tube in some cases of profound nausea following deep and prolonged chloroform anæsthesia of the horse, it was decided to try a mixture of normal saline solution and formalin in colic. The result was so satisfactory that it soon became the routine treatment, and during the last sixteen months every case of so-called colic, with rare exceptions, has been treated by normal saline solution and formalin. Other agents have at times been added, and it is remarkable the quantities of different drugs and the amount of fluid that can be introduced in this way into the horse's stomach with nothing but good results. On one occasion when summoned late in the evening to a case of obstruction of the double colon that had been in severe pain for twelve hours, [illegible] administered in a single dose 1 oz. chloral hydrate, 3 drs. aloes, 5 pints linseed oil, 1 oz. formalin, ½ lb. common salt in 6 gallons of water. No further treatment was required. Similar doses have often been employed, but for general purposes 1 oz. formalin, ½ lb. salt in 4 gallons warm water meets the bill, and can hardly be improved upon. If relief does not follow in the course of two or three hours—a rare experience—a similar dose can again be given, or the ingredients added to or changed. Our usual practice is to give a similar dose of formalin, half the quantity of salt, a large quantity of water, adding linseed oil and/or chloral hydrate as we think advisable. It frequently

happens that during the exhibition of the mixture per stomach tube the patient becomes a little restless ; this need give no alarm, but when it does happen it is our practice to desist for a short time, but keeping the tube in the stomach until the process is again gone on with. In some instances, also, we have noted an aggravation of the symptoms—what one would rather describe as an uneasiness, shortly after the administration. This does not persist long, is not in the least alarming, and is never in any way comparable to the distressing symptoms that so frequently follow the employment of barium chloride given orally, or eserine or other similarly acting agent given hypodermically. This method of treating colic is also an aid to diagnosis. Gastric tympany is never overlooked, and when this is present, relief is immediate and permanent, and rupture avoided. In secondary tympany arising from retention and fermentation of the food in the stomach due to arrest of peristalsis, more or less relief follows the introduction of the tube into the stomach, and the lesion or obstruction causing arrest of peristalsis may consequently be more easily dealt with. When there is complete obstruction in the small intestine, the fluid introduced remains in the stomach or returns through the tube. It may thus become a further aid to diagnosis.

The advantages of this method are : It is a valuable aid to diagnosis; there is no risk of foreign body pneumonia ; the exact quantity of medicine is known ; there are no harmful results to the mucosa of the alimentary tract from concentrated, irritating medicaments ; disinfection of the gastro-intestinal tract ; the risk of rupture of stomach or bowel is reduced to a minimum, or absent ; absence of nausea ; early recovery and return to work ; the animal often starts to feed as soon as the pain disappears ; no risk of super-purgation ; from close observation, the percentage of cases developing displacement of the bowel, after treatment has commenced, would appear to be greatly reduced ; it may be employed without hesitation to in-foal mares.

For these reasons we believe that it is the best treatment for, and is not contra-indicated in any of the various disorders commonly termed colic. A possible exception is so-called spasmodic colic, accompanied by fluid or semi-fluid evacuations, for which chlorodyne and a moderate dose of raw linseed oil may be given instead.

Diarrhœa.—Formalin in doses of one or two drachms may be added to the ordinary remedies for this, or given alone in flour gruel. Generally speaking, we prefer to give it in half to one ounce doses in normal saline, and have found it very serviceable in some cases of diarrhœa in cattle.

For scour in sucklings, the best method is to administer the formalin and saline to the mother once daily per stomach tube, and to give in

addition formalin in two drachm doses twice daily in bran mash (to the mother). Other agents such as castor oil may be given to the suckling, and followed up with grey powder or other drug that may be considered more suitable for the case. Generally, however, the saline and formalin alone treatment for the mother is successful.

Gastro-intestinal auto-intoxication of some degree is probably a not infrequent accompaniment of so-called colic, so that a vicious cycle is created, complicating the case. One pronounced case due to paresis of the bowel owing to a chronic lesion of the bowel wall, treated by formalin and normal saline is perhaps worth recording. Briefly the symptoms were : Animal—a mare—stood with all four limbs close together, the body projected forward, head carried low, or with nose resting on the manger, or pressing against the wall or other object. When compelled to move, the gait was unsteady, staggering, pulse infrequent, slow ; temperature slightly subnormal ; appetite in total abeyance, bowels torpid. The mouth could with difficulty be opened and that only slightly ; the tongue appeared swollen and furred ; odour from mouth was most offensive. Six drachms of formalin and a half pound of salt in four gallons of water were administered per stomach tube at midday. In the evening an improvement was noted, and one ounce of formalin and four ounces of salt were given in three gallons of water. Next morning there was a transformation of the clinical picture. The patient was particularly cheerful, firm on her legs, moved freely about the box of her own accord with head erect, ears pricked, and looking anxiously for food, which she greedily devoured. The disagreeable odour had left the mouth, which was easily opened, and the tongue was almost normal. The box was littered with great heaps of somewhat dry fæces.

Toxæmia from pustular eruption of the skin in Strangles.

Called urgently to a mare that had suddenly collapsed in her box. On arrival I found my patient lying stretched out flat on her off-side and grunting with every expiration ; pulse about 80, and of fair volume and tone ; temperature 103·8, and the eyes oscillating in a remarkable manner. An attempt to raise the head failed, and gave one the impression that the muscles of the off-side of the neck were spasmodically contracted.

History.—Mare had foaled three weeks previously while suffering from a " strangling cold," an abscess having formed and burst in the intermaxillary space. Other abscesses of varying sizes had subsequently appeared in different parts of the body. When seen by the writer, parts of the body were covered by innumerable small abscesses ; and a cold abscess in the intermaxillary space noted. The case seemed hopeless. One and a half ounces of formalin

and three-quarters of a pound of salt in six gallons of water was given by stomach tube. About fifteen hours later she rose without assistance. Nystagmus still present, but less marked. Twenty-four hours later oscillation of the eyes was still in evidence, but had disappeared after another twelve hours. The mare received a second dose of formalin and saline solution similar to the first the next day. Other two doses were subsequently given with an interval of some days between. During the two weeks following the first visit, the mare received formalin in two drachm doses given in mash. Three weeks after first visit she had made a perfect recovery, but was still down in condition.

An unnamed affection of cows.—This has been recognised by the writer for many years, but a description of it has never so far as he is aware appeared in print.

The usual history from calving, up to a period of twelve days, never less and generally a little more; the animal has done well, feeding, milking, and in every other way behaving satisfactorily. But about the time mentioned *the appetite fails for everything but fodder, the secretion of milk is suddenly and greatly reduced in quantity. The animal loses flesh rapidly, and presents an empty appearance* (clapped). *The fæces are dry and passed in cakes, which have a glazed or glistening appearance.* The temperature throughout is normal and the pulse generally little altered, at least in the early stages. The bowels do not respond readily to laxatives or purgatives, and soon dry up after being opened. The lochial discharge is scanty, or entirely suppressed. Complications, such as nervous phenomena, never develop. Formalin in two drachm doses repeated three times a day in large quantity of gruel or water has seldom or never failed to effect a cure during the last twenty years. If resorted to at once, two or three doses are generally sufficient, but when treatment is delayed or in individual cases, larger doses may be necessary. The formalin is generally combined with powdered nux vomica. The diagnosis is based on the history and the definite train of symptoms—none of which is ever absent.

It can be confused with other affections which sometimes occur about the same period; for instance, what is sometimes termed gastric milk fever. The latter almost invariably occurs within the first week. The animal shows lack of appetite, irregularity of the bowels, and there is generally a sweet mawkish odour from the breath, which sometimes pervades the whole premises. It responds readily to the treatment for milk fever, but not to the formalin treatment, and there is not the complete train of symptoms always found in the unnamed affection. In what has been termed deferred milk fever, the animal often shows lack of appetite, etc., *i.e.*, symptoms similar to those of

last case, but sooner or later is apt to develop the usual symptoms of milk fever, only the nervous phenomena are generally of a much more violent type—sometimes rabiform—the patient attempting to attack the attendant with horns or feet, or in other instances viciously, and persistently licking some part of her body.

It responds to inflation, but not to formalin treatment. A full dose of chloral hydrate is a good adjunct to the treatment. Other cases of indigestion due to sudden and complete change in the diet, irrational feeding, etc., are not infrequent after calving, and may, but should not be, confused with the " unnamed affection."

Joint-ill in foals.—The same treatment as advised for scour in sucklings is employed. Subacute cases characterised by lesions in the joints, causing a moderate degree of swelling and lameness, slight elevation of the temperature, etc., often respond quickly to treatment. More acute cases of the same type with marked distension of the joint capsule—high temperature, etc., sometimes defy treatment, or may only respond when the joint is tapped with a hypodermic needle ; a large proportion of the fluid allowed to flow out, and a drachm of tincture of iodine injected. This can be repeated as often as is necessary, allowing an interval of a week between the injections. Of three foals so treated a year ago, there is only one showing a slight enlargement of the joint, which it is expected will ultimately disappear. In cases of the acute septicæmic type which occur within the first few hours of life run a rapid course, terminating fatally in 24 to 48 hours. The treatment is, of course, useless.

Purpura Hæmorrhagica.—For this formalin may be given intravenously in two drachm doses in ten ounces of water at blood heat. It should be repeated a week later (earlier if necessary), whether the condition of the animal seems to require it or not. It may, however, be given in the food or per stomach tube, when a larger dose is required, and repeated as necessary. In the absence of internal lesions, recovery generally occurs.

Laminitis—Lymphangitis—Azoturia.—In each of these diseases, one ounce of formalin in saline solution will be found very serviceable, and should be repeated daily for several days if indicated.

Parturient Septicæmia Mammitis.—Give as in *Laminitis*, but if case severe, four drachm doses should in addition be given twice daily in the food—a mash with treacle.

Canker of the horse's foot.—Formalin in 1-5 per cent. solution is, in certain cases, sometimes of service, but for conducting a case to perfect recovery other agents are much to be preferred. A method which we have found very satisfactory is as follows : The horn overlying the affected parts is carefully removed to avoid the drawing

of blood, the parts thoroughly cleansed with hydrogen peroxide, dressed lightly with ether or spirit, and when clean and dry as possible, anointed thoroughly and carefully with following paste, preferably prepared fresh: Iodoform 4 parts, charcoal 2 parts, liquid paraffin 3 parts. It is essential that every part of the affected tissue be thoroughly dressed.

The affected parts are packed with cotton wool, in such a way that it is likely to remain in position. The whole is then covered with fine tow and the foot kept as dry as possible. Old standing chronic cases, after being thoroughly cleansed as already advised, may be dressed with advantage in some cases with a 5 per cent. solution of formalin and then anointed with a paste as above—*cupri subacet* 3 parts being substituted for charcoal 2 parts. The dressing should be repeated every second day in bad cases, but if details are carefully attended to, it will soon be found that dressing at an interval of several days is sufficient. As the case improves, an interval of a week or more between the dressings should be allowed.

Formalin in one ounce doses should be given daily in bad cases by stomach tube, or in two drachm doses three or four times a day in a mash.

Grease.—Except in old, chronic cases, where there is structural alteration of the skin, the treatment internal and external, is the same as for canker.

For wounds, chapped teats, sore backs, sore shoulders, removing particles of chaff embedded in the exudate on the cornea, one part of formalin to 750 of water is used, and repeated several times daily if necessary.

If pain is great, 1 per cent. cocaine hydrochlor. is added.

For irrigation of wounds after radical operation for poll evil, fistulous withers, one of formalin to 1,500 of water. The strength is increased according to needs.

Remarks.—Apart from diseases of the stomach and bowel *per se*, many affections, including some of those of doubtful or of unknown etiology, take their origin in the gastro-intestinal tract. From some cause, such as catarrh, ulceration, certain food stuffs, dietetic errors, etc., the defence of the mucous membrane becomes impaired or broken down, and so toxic substances, organisms, or their products enter the portal circulation, producing results which vary with the cause.

Thus we may have intoxication of the central nervous system (stomach staggers, grass staggers), or disease in any other organ of the body. The successful treatment of many conditions so caused often presents a problem of great difficulty to the clinician. Each

type of case is treated on its merits, but generally speaking, removal of any offending material, destruction or inhibition of the action of organisms, neutralisation of toxins, and restoration of the weakened membrane are indicated.

In these circumstances purgatives—in both horses and cattle—are often uncertain in action, add to the irritation already existing, and sometimes are followed by disastrous results.

The need, therefore, for some agent or combination of agents that could be relied upon to empty and purify the intestinal canal without risk of causing irritation, nausea, superpurgation, or other adverse result, is very real.

Does formalin in normal saline solution, combined, if need be, with linseed oil, supply the want? Does it do more? Does it enter the circulation, neutralising toxins circulating in the blood, and even reach the centres of disease with beneficial results?

In the writer's opinion in some instances it does in some measure do all these things. But it will require to be tested and retested before its action can be definitely established and its real value appraised.

To Mr. Lang, who brought the stomach tube and some of the properties of normal saline to his notice, the writer has already acknowledged his indebtedness. He has also to thank Mr. Forbes, of Kilmarnock, for pointing out the fact that horses generally speaking, take formalin in bran mash.

THE HUMANE SLAUGHTER OF ANIMALS.

(*Continued from page* 248.)

By GEORGE E. BODY,
Meat and Food Inspector, Torquay.

The Blood and Serum.

Letters and articles have recently appeared in various journals drawing attention to the effects shooting has on the bleeding and the small amount of serum expressed from a known quantity of blood.

So far as I can ascertain the Belfast investigation has been the only test carried out, so this has been taken as a scientific standard, although I doubt if the Belfast experts would consider their few cases sufficient on which to base a standard.

Of course I am not aware of the precautions taken so as to assure that each sample was normal. But to take 250 c.c. from approximately 2 gallons of blood from each animal, set it apart and compare its colour and quantity of serum expressed, and assume each to be a normal sample, seems to me neither scientific or even fair, as so many

conditions, apart from the mode of slaughter, affects the colour and quality of blood, especially the amount of serum expressed. For instance, the shape of the vessel in which the blood is retained, the method of catching, whether poured from one vessel to another as is usually the case in obtaining a sample of blood from a bullock, how handled after placing in the retaining vessel, and the period at which the samples were taken, *i.e.*, whether at commencement of bleeding, towards the final flow, or at a period between the two.

It may appear strange, but tests have proved it to be true, that the amount of serum expressed from samples taken at three different periods of bleeding show variation in quantity as well as in colour, but the totals together have shown a variable quantity. Therefore the only fair and accurate method, in my opinion, is to obtain the maximum quantity from each animal and compare the weights obtained with the weight of the animal.

In the forty cases investigated by me it will be observed that the metinân antity of blood and serum from shot animals exceed that eobaqud from animals stuck, but only to a very slight extent.

TABLE I.

SHEEP AND LAMBS. STUCK.

No.	Date.	Animal.	Weight of Carcase.	Weight of Blood.	Weight of Serum.	Percentage of Blood.	Percentage of Serum.
			lbs.	lbs.	lbs.		
1	11/4/21	Sheep ...	78	6·00	·25	7·6	·32
2	11/4/21	Sheep ...	70	6.05	·62	8·6	·88
3	11/4/21	Sheep ...	90	7·12	1·00	7·9	1·10
4	12/4/21	Lamb ...	35	2·25	·25	6·4	·71
5	12/4/21	Sheep ...	79	6·22	·25	8·2	·31
6	12/4/21	Sheep ...	73	3·93	·81	5·3	1·10
7	18/4/21	Sheep ...	79	5·74	·37	7·2	·47
8	19/4/21	Sheep ...	100	6·00	·50	6·0	·50
9	19/4/21	Sheep ...	77	3·50	·25	4·5	·32
10	25/4/21	Sheep ...	88	5·43	·81	6·1	·92
11	10/5/21	Sheep ...	78	3·74	·37	4·7	·47
12	10/5/21	Sheep ...	70	4·49	·87	6·4	1·20
13	3/5/21	Lamb ...	49	3·47	·92	7·0	1·80
14	3/5/21	Lamb ...	51	3·87	1·18	7·5	2·30
15	5/5/21	Sheep ...	71	4·81	·75	6·7	1·05
16	5/5/21	Lamb ...	42	2·18	·87	5·2	2·07
17	11/5/21	Sheep ...	67	2·74	·12	4·0	·18
18	19/5/21	Sheep ...	97	3·90	·66	4·0	·68
19	19/5/21	Sheep ...	69	5·06	1·31	7·33	1·80
20	19/5/21	Sheep ...	52	3·93	1·07	7·5	2·00
	Totals	... ...	1,415	90·73	13·23		
Average of 20 Animals ...			70·7	4·53	·66	6·40	·93

TABLE II.
SHEEP AND LAMBS. SHOT.

No.	Date.	Animals.	Weight of Carcase.	Weight of Blood.	Weight of Serum.	Percentage of Blood.	Percentage of Serum.
			lbs.	lbs.	lbs.		
1	11/4/21	Sheep ...	61	4·64	·37	7·6	·60
2	11/4/21	Sheep ...	60	5·75	·31	9·5	·51
3	11/4/21	Sheep ...	90	6·37	·37	7·0	·41
4	12/4/21	Sheep ...	86	4·50	·50	5·2	·58
5	12/4/21	Lamb ...	53	2·91	·35	5·5	·66
6	18/4/21	Sheep ...	72	4·91	·60	6·8	·83
7	18/4/21	Sheep ...	64	5·50	·75	8·6	1·10
8	19/4/21	Sheep ...	63	4·07	1·00	6·4	1·58
9	25/4/21	Sheep ...	67	4·50	1·00	6·7	1·49
10	2/5/21	Sheep ...	105	5·49	·87	5·2	·82
11	2/5/21	Sheep ...	67	3·51	·44	5·2	·62
12	3/5/21	Sheep ...	63	4·36	1·36	6·9	2·10
13	5/5/21	Lamb ...	42	3·00	1·12	7·1	2·60
14	11/5/21	Sheep ...	96	4·81	·62	5·0	·64
15	11/5/21	Lamb ...	45	2·73	·49	6·0	1·08
16	23/5/21	Sheep ...	80	5·50	·50	6·8	·62
17	26/5/21	Sheep ...	51	2·85	·49	5·8	·96
18	26/5/21	Sheep ...	88	6·00	1·12	6·9	·13
19	26/5/21	Sheep ...	72	4·88	·57	5·9	·79
20	26/5/21	Sheep ...	76	5·75	·43	7·56	·56
	Totals	... ...	1,401	92·03	13·26		
	Average for	20 Animals	70	4·61	·66	6·5	·94

TABLE III.
SAMPLES TAKEN AT VARIOUS PERIODS OF BLEEDING.
STUCK ANIMALS.

No.	Date.	Animal.	Weight of Carcase.	Weight of Blood.	Weight of Serum.	Remarks.
			lbs.	lbs.	lbs.	
(1) 1st	19/5/21	Lamb ...	51	·93	·37	Serum clear.
2nd				·86	·30	Serum very clear.
3rd				1·43	·25	Serum pink.
			Total	3·22	·92	
(2) 1st	19/5/21	Lamb ...	49	*·87	·31	Serum pink.
2nd				1·99	·62	,, bloodstained
3rd				1·00	·25	Serum clear.
			Total	3·86	1·18	
(3) 1st	17/5/21	Sheep ...	97	*·78	·16	Serum clear.
2nd				·87	·25	Serum clear.
3rd				2·25	·25	,, bloodstained
			Total	3·90	·66	

* Blood poured into vessel.

TABLE IV.

SAMPLES TAKEN AT VARIOUS PERIODS OF BLEEDING.
SHOT ANIMALS.

No.	Date.	Animal.	Weight of Carcase.	Weight of Blood.	Weight of Serum.	Remarks.
			lbs.	lbs.	lbs.	
(1) 1st	19/5/21	Sheep ...	63	·93	·37	.....
2nd				1·37	·37	.....
3rd				2·05	·62	.....
			Total	4·35	1·36	
(2) 1st	17/5/21	Lamb ...	45	*·87	·25	Serum clear.
2nd				·43	·12	,, bloodstained.
3rd				1·43	·12	Serum clear.
			Total	2·73	·49	
(3) 1st	26/5/21	Sheep ...	72	*·68	·07	Serum bl'dst'ed.
				3·63	·50	Serum clear.
			Total	4·31	·57	
(4) 1st	26/5/21	Sheep ...	76	*·56	·12	Serum stained.
				4·75	·31	Serum clear.
			Total	5·31	·43	
(5) 1st	26/5/21	Sheep ...	51	*·62	·12	Serum stained.
				·74	·12	Serum clear.
				1·81	·25	Serum clear.
			Total	3·27	·49	

* Blood poured into vessel.

These results compare favourably with those obtained by other investigators ; regard must, of course, be paid to the differences between the live and dead weights.

The weight of the animals in my Tables are the weights of the dressed carcases ; those reported on by Goltz are the percentages obtained from the weight of the live animals.

Goltz demonstrated by careful weighing that in the large food animals bleeding after stunning was not less complete than after cutting the throat without stunning.

IN CATTLE.

(*a*) In slaughtering according to the Jewish method, 3·24 per cent. of the live weight.

(*b*) In using the shotting mask (*i.e.*, a form of pistol discharging a ball cartridge), 3·20 per cent. of the live weight.

(*c*) In using the striking mask (*i.e.*, a mask containing an iron bolt, which is driven into the brain by means of a wooden mallet), 2·89 per cent. of the live weight.

In Calves.

(*a*) In slaughtering according to the Jewish method, 4·90 per cent. of the live weight.

(*b*) By the butcher's method of cutting the throat, 4.90 per cent. of the live weight.

(*c*) By a blow with the hammer, 5·67 per cent. of the live weight.

In Sheep.

(*a*) In slaughtering by the Jewish method, 4·15 per cent.

(*b*) By cutting the throat or severing the carotids, 4·31 per cent.

(*c*) By a blow with the hammer, 4·35 per cent.

Or expressed in other words, a beef animal of 700 kg. lost :—

(*a*) In slaughtering according to the Jewish method, 22·68 kg. of blood.

(*b*) By use of the shooting mask, 22·40 kg. of blood.

(*c*) By use of the striking mask, 20·23 kg. of blood.

A calf of 60 kg. live weight lost :—

(*a*) By the Jewish method of slaughtering, 2.95 kg. of blood.

(*b*) By the butcher's method of sticking without stunning, 2·94 kg. of blood.

(*c*) By a hammer blow, 3·04 kg. of blood.

A sheep of 50 kg. live weight lost :—

(*a*) By the Jewish method of slaughtering, 2.07 kg. of blood.

(*b*) By the butcher's method of killing without stunning, 2·15 kg. of blood.

(*c*) By a hammer blow, 2·17 kg. of blood.

P. Falk called attention to the fact that he found no difference with regard to the keeping qualities in meat preserved in cold storage whether the animals had been killed according to the Jewish method or by killing after a previous stunning.

These investigations, I consider, prove conclusively that shooting does not retard free and adequate bleeding or the retention of serum in the carcase, but really assists the process, especially if the medulla oblongata or spinal cord is not damaged, as in the medulla oblongata are found the centres of respiration, heart action, dominating vasomotor centre, and the centre of muscular contractions.

The effectual removal of the blood and serum from animals killed with the pistol also controverts the absurd theory, recently expressed, that animals killed by the Jewish method of slaughter accounts for the freedom from cancer of the Jewish race.

Needless to say, the medical profession long since rejected the possibility of man contracting cancer from the consumption of home-killed meat. In fact, a vast number of investigations have shown that cancer cannot be transmitted from animals to man, or even from one animal to another.

In a lecture given by Professor H. A. Woodroff on "Signs of Health and Disease in Food Animals," he states :—"There was another cause of disease, but one they were not troubled with much, namely, tumours. Animals had tumours of various kinds, and sometimes they had cancer. In this matter he could affirm that cancer of the ox, sheep or pig would not be transmissible to the human subject. Certainly such a carcase so affected would be seized, but anyway there would be no fear of transmission of the disease to human beings, a fact now being recognised by the best authorities. Cancer could not be transmitted from one species to another."

Ostertag states :—"Individual organs, which enclose malignant tumours, must be considered a spoiled food material. Despite the fact that sarcomata and carcinomata occur in man, such meat is not dangerous to health for the reason that, according to all experiments, the transmission of these tumours by means of the digestive apparatus is impossible. Among hundreds of experiments that have already been made, it has only been possible, in a few isolated cases, to transmit cancer from animal to animal by introperitoneal injection and to inoculate with fibro-sarcomata."

In reference to the variation in colour of the blood when drawn from the animal, I have found that quite as many animals stuck without previous stunning bleed as dark as some shot.

The reason for this is obscure, but the most feasible explanation, to my mind, is that strange surroundings, the smell of blood, the handling of the animals previous to slaughter, and the general commotion associated with a slaughter-house, affects the nervous system of some animals more than others.

In the majority of cases where the blood is darker than normal a short exposure to the atmosphere turns the blood to its usual bright colour. In fact, I have found it impossible, except in a very few isolated cases, to detect one sample from another without reference to its distinguishing number.

Certainly a few samples have shown a small quantity of liquid blood, or blood coloured fluid, between the blood clot and the serum, but these conditions arose, in my view, to excessive splashing when blood was caught in the vessel, or rough handling of the vessel immediately preceding clotting.

Keeping Qualities of the Meat.

As regards the keeping qualities of the meat of animals killed by me with these humane slaughtering appliances, I have found it impossible to detect the slightest difference in the appearance, setting or keeping qualities of the meat of these animals from those killed in

the ordinary way. Neither have I received complaints respecting the condition of the carcase or organs (although about 130 animals have been killed this way), except for the small amount of hæmorrhage round the brain. Intending purchasers, so I have been informed, have refused the brains owing to their blood-stained condition. Even if this is the case, it is really only a question of the external appearance of the organ, as the brain substance is no more damaged than from one stuck. Where the lobes are much broken up it generally arises from bad splitting of the head with the chopper ; but even in cases of excessive hæmorrhage, the blood is easily removed from the brain or brain cavity by soaking in salt water.

It seems strange, in view of the hundreds of thousands of animals that have been killed by shooting (the Greener killer to my knowledge has been in use for over 20 years, and many butchers I have met in my official capacity as meat inspector have killed all their large animals with a shot gun, a marble or piece of lead taking the place of the ball cartridge), yet I have never heard them say that such mode of killing had any detrimental effects on the meat. Neither, during my experience as a meat inspector, can I recollect being called to examine meat that had " gone wrong " owing to the animal having been shot.

Yet certain members of the butchering trade still have the hardihood to aver that the flesh of shot animals decomposes much more rapidly than that of animals pole-axed, a contention that has been much stimulated by the Belfast investigations. Still, I think the keenest opponent to humane slaughtering must admit that the Belfast investigation on two animals pole-axed and two animals shot looks rather foolish when compared with hundreds of thousands that have been shot during the past quarter of a century, without, so far as I can ascertain, representations being made to the authorities of the loss entailed from this method of slaughter.

Where certain carcases have deteriorated other reasons than the mode of killing must be sought as the cause of early decomposition.

Clinical.

TECHNIQUE FOR THE EARLY DIAGNOSIS OF HABRONEMIASIS.

By Major J. R. HODGKINS, D.S.O., F.R.C.V.S.,
Secunderabad, India.

The appearance of an animal suffering from verminous gastritis due to *habronemar* is sufficiently characteristic when combined with a reliable history of the case, to warrant one, after some experience, in giving a diagnosis.

Nevertheless, correct and precise diagnosis can only be based on the finding of the parasites.

Fæcal searching is a tedious process, and may occupy hours without result.

By the method about to be described, the matter can be reliably settled in ten minutes. Apparatus required is a stomach tube and two buckets of water, hot enough to be introduced into the stomach without injury. To those unversed in the use of the stomach tube, the perusal of an article ("Hydro-Therapy in the Treatment of Colics," Veterinary Journal, May, 1920, p. 168), by Major Saunders, D.S.O. is recommended; also numerous articles and demonstrations before Veterinary Societies by that sturdy pioneer of the method in Great Britain, Mr. W. W. Lang, M.R.C.V.S.

Preparation of the patient.—The animal should be fed on bran mashes without hay for two days, and then fasted for a period of thirty-six hours.

Operation.—The animal should be placed in stocks or not according to temperament, and the stomach tube passed *secundum artem*.

The stomach is then filled with the hot water, that is to say, three or four gallons should be pumped into it.

An interval of several minutes having elapsed, the animal's head is lowered and by syphonage the liquid and other contents of the stomach are withdrawn.

A second (empty) bucket should be in readiness. This should have previously been covered over its mouth by blotting paper of several thicknesses. To support the paper and assist the straining, the blotting paper must be wrapped in gauze.

Now the mucous coat of the stomach is heavily coated with mucin. This is so firmly adherent that it requires considerable force to detach it. In and underneath this mucin are situated the worms. For diagnostic purposes one must remove this mucin.

It is a physiological fact that less mucin is formed during hunger than in activity (Smith, "Veterinary Physiology," 5th Ed., p. 193),

and our experience has been that it is easier to detach by hot water than cold water. Hence the recommendation for the long fasting period and the use of the hot water.

The syphonage and refilling of the stomach must be continued until the mucin comes away. This usually occurs, however, near the termination of the exit of the first three or four gallons of hot water.

The myriads of worms that descend the tube with this mucin must be seen to be appreciated.

This opens up a wide vista of new methods of treatment for the worms (*H. microstoma* and *H. muscae*) situated on the mucous membrane.

But what of *H. megastoma* safely ensconced in the sub-mucous abscess?

MUDSORE IN ELEPHANTS.

By M. C. GUPTA,
Veterinary Graduate, c/o. Macgregor & Co., Toungoo.

Nomenclature.—The term "Mudsore" is fairly well-known in Burma among men who work in the forests during the rains. As the symptoms in both men and elephants are more or less identical, this name has been appropriately chosen for the sores of elephants which occur during the wet season.

Geographical Distribution.—So far as I can gather information in Burma, elephants of Messrs. Macgregor & Co., Ltd., are subject to this disease in the working forests of the Toungoo District. The disease first started in the North Toungoo Division forests at Zadipo Chaung in the rain season of 1916. A few mild cases also happened in the same district not far from the infected area, the history of which points to the fact that the animals might have been grazed in or near this particular stream. In 1917 there were a few cases of a very mild form at Myohla Chaung, and only one case at the West Swa. There was a fresh outbreak in 1918 at Palabyauk Chaung in the Pyinmana Forests. One herd, consisting of ten elephants, was affected. This year (1921) the attack was in its most virulent form, and affected largely the working herds at Madan (Pyinmana). It is interesting to note that there are few or no cases amongst the elephants in the South Toungoo Forests.

Etiology.—The sores are generally attributed to originate in scratches from thorns or splinters in the jungle. That abrasions of this kind are the starting point is indicated by the fact that the sores rarely occur elsewhere than on the legs below the knees, the commonest sites being the shins, ankles, dorsum of the feet, and toe-nails. Amongst human beings, as far as my experience goes, the disease is

common to those men who do rough out-door work and keep their legs wet in slush and mud. The same theory is applicable to elephants.

It is a disease essentially endemic and not epidemic. The season when the elephants are more severely affected is the middle and end of the rains. In the present outbreak of 1921 it, however, occurred in the cold weather.

From several scrapings taken from the affected elephants their microscopical examination showed a small, slender, non-motile gram-positive bacillus 3·0 to 3·5 in length, showing bipolar staining, and sometimes a beaded appearance, which I found constantly present in the sores. I was not successful in inoculating the sores into men or animals by the ordinary method of vaccination. But I succeeded in producing a typical sore in a man by binding a swab from an ulcer of an elephant on to a partially-healed abrasion for 24 hours.

The only account of Oriental sore which I have for comparison between the human beings and animals is that given in the latest edition of Castellani & Chalmer's " Tropical Medicine." This account at present sight does not correspond very closely with mine.

Now the question is whether the disease is a true Oriental sore, due to *Leishmania tropica*, as described in the medical text-books ? I have failed to find *Leishmania* in scrapings. It is entirely possible that the organism is a secondary invader or produces the disease to a kind of symbiotic relationship with the *Leishmania tropica*.

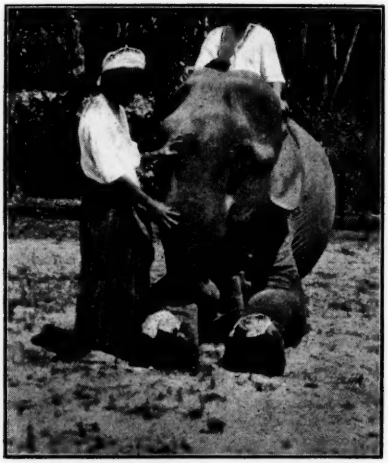

FIG. 1.—Mudsore on the Top of the Feet.

SYMPTOMS.

(1) *Mode of Commencement.*—The sore begins usually as a vesicle or papula, which quickly becomes vesicular, with an inflamed areola. The vesicle soon ruptures, and a small deep circular ulcer with a sloughing floor is formed. The ulcer grows rapidly for from three to ten days, destroying the skin and eating into the subcutaneous tissues till it attains a very big size. It is nearly always strictly circular and deeply cupped into the undermined edges. In most cases the growth of the ulcers now becomes arrested, and after a variable but usually prolonged stationary period it at last granulates up and heals in some six to eight weeks from its start. In many cases it takes much longer to heal and becomes " callous " with indurated, almost horny edges. In a certain percentage of cases the phegadenic process is more virulent and prolonged, and the sore may attain a comparatively large size, infiltrating and destroying muscles and tendons, and even extending to the bones. In two cases of the present epidemic gangrene supervened.

As mentioned above, the sores are nearly always situated on the legs below the knees. They are very often multiple. Constitutional disturbance is absent except in rare gangrenous cases. The sores are extremely painful. I have in my mind a clear picture of the unfortunate elephants standing in the stall of the temporary hospital built for them and having their sores dressed, and displaying in their features the utmost misery and pain. They could not bear to have their sores touched, and dressing them was a painful business.

(2) *Mode of Growth.*—Extension commonly takes place in two ways, viz. : (*a*) by simple growth of the primary nodule, which may be continuous and uniform or intermittent and irregular. It generally maintains a roughly circular shape, or (*b*) secondary papules may form in the areola of the primary nodule sometimes all round it, sometimes on one or other side, and often at a distance of an inch or two inches. The sores grow and proceed to coalesce, forming an extensive raised warty patch, which may be two, three or even more inches in its major axis. Its common shape is irregularly oval and seldom circular. In its natural untreated state it is found to be covered by a rough scale formed by the drying of discharge which comes from its surface.

(3) *Stage of Ulceration.*—Sooner or later in a large proportion of the sores a stage of definite ulceration sets in. It generally begins soon after the first attack. In a few cases the sores gradually dry up and shrink without breaking down into ulcers.

When ulceration does set in the centre of the sore breaks down and definite loss of substance takes place. This proceeds solely at the expense of the neoplasm, and does not extend beyond the infiltrated area of the skin. Deep tissues are also invaded. The depth of the

ulcer depends on the thickness of neoplasm. In the prominent fungating sores an excavation of some depth may form. In the flat, dry sores there may appear to be nothing but a loss of surface epithelium. The edges of the ulcer are ill-defined, irregular and sometimes jagged. In some cases they are also undermined. On probing or scraping the sore it is found to consist of a thick layer of friable granulating tissue, which may have infiltrated and destroyed the whole thickness of the skin and sometimes penetrating the deep structure. This description is based on naked eye appearance only, and not on histological examinations.

The ulcer, if it does not proceed to heal, loses in time its characteristic appearances. The nodular overgrowth disappears. The margins become clear cut and often undermined, the granulating

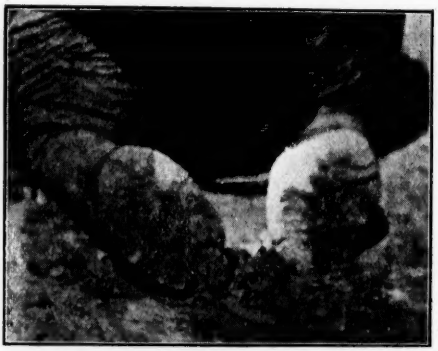

FIG. 2.—Showing the position of the Sore under the Foot.

floor becomes dry and indolent, and the edges sometimes hard and horny. The sore, in fact, becomes an ordinary indolent ulcer with no destructive peculiarities to indicate its origin. The prolonged parasites have probably all died out by now.

In size the sores vary from a couple of inches to six inches—sometimes more—in diameter. In prominence they vary greatly. Some are most projecting growths, raised an inch above the level of the skin, and resembling at first sight fungating epithelium. Such growths are sometimes very fœtid. They are frequently multiple, and generally occur at the dorsum of the lower extremities.

(4) *Stage of Healing and Treatment.*—Healing usually sets in satisfactorily under hypochloric acid treatment. This is a valuable germicide, and by far the best and cheapest antiseptic. Wax, catechu and other indigenous drugs are generally used as a coating. The treatment,

so far, has proved very successful, and even stubborn cases have yielded with time and patience. The prognosis is generally favourable if the diagnosis is made at the early stage and treatment taken in hand at once.

REFERENCES.
(1) *Veterinary Journal.*
(2) *Indian Medical Gazette.*
(3) "Manual of Tropical Medicine" (Castellani & Chalmers).

SUSPECTED POISONING OF EIGHT CATTLE.

By W. F. ASTON, M.R.C.V.S.,
Ludlow.

THE subjects were two-year-old crossbred cattle, feeding on bean stubble which was full of weeds, though none were believed to be noxious.

On August 28 several were noticed to be failing somewhat, yet on the 30th they still appeared to be healthy and ate well. The next day four were ill and eating nothing, death of one occurred on September 2, another on the 7th, and two others were slaughtered the next day when recovery was seen to be hopeless.

The symptoms were total loss of appetite, great thirst, colicky pains, cessation of rumination, and constipation, which was followed by straining and bloody discharges of a small quantity of fœtid fæces.

As the cases progressed, great prostration supervened, followed by varying degrees of pneumonia. There was no great rise of temperature throughout the illness, and the pulse was firm, though accelerated the first few days. Respirations were hurried, and as the conditions developed, a moaning inspiration and a most marked sinking of the eyeball in the orbit. The symptoms varied, but slightly in all the cases.

The three beasts which lived made a quick recovery, and in three weeks were in as good a store condition as at the commencement of the illness. As the affection was so severe in those which succumbed, this is noteworthy as suggesting an irritant poison quickly thrown out.

Post-mortem revealed acute gastritis and enteritis; in one case there were small ulcers on tongue and larynx; an extensive black pigmentation of the rumen and bowels in two cases, and in the others to a less degree. There was atrophy and fatty degeneration of the liver and spleen, which in one case was so small it could hardly be found. Pneumonia was present in those which lived the longer.

There have been no other cases of similar illness on the farm.

As sources of poisoning, the following are suggested: The weeds, paint, etc., from building operations which might have been carried in the water, or oil from a leaky tractor. There was no bracken on the farm, though the symptoms are suggestive.

The examination of the stomach walls and contents revealed no mineral or organic poisoning, and the cause is still one for speculation.

TUBERCULOSIS IN THE CAT.

By WILLIAM L. LITTLE, M.R.C.V.S.
(*Reading.*)

THE following case was thought of sufficient interest to report. The subject was a half-bred Persian cat, nine months old, admitted to hospital for partial paralysis of the hind limbs, the animal falling over occasionally during walking. The left spermatic cord was enlarged and hardened, thought to be due to an accidental infection at the time of castration. After about one month, the left eye showed what appeared to be pus in the anterior chamber, and after a few days the lens became dislocated, and apparently absorbed, the iris being contracted ; the retina, too, appeared affected.

At this stage the patient was seen in consultation by Professor Hobday, and as palpation of the mesenteric glands revealed that these were distinctly enlarged, a diagnosis of probable tuberculosis was discussed with the owner, and the cat was destroyed.

On post-mortem examination, the left spermatic cord was found to be affected up to the inguinal ring ; the mesentery was much inflamed, and the colon showed enteritis. The mesenteric and thoracic glands were much enlarged ; the lungs showed no macroscopic lesions. The right hemisphere of the cerebrum had a caseating nodule the size of a horse bean attached to the *Dura Mater*, the brain case being affected over the nodule.

Sir J. McFadyean kindly examined the lesions and confirmed the diagnosis of tuberculosis.

The cat had been reared from a kitten by the owner, and had always been given a plentiful supply of cow's milk. I could not obtain any evidence of contact with any person or animal affected with tuberculosis.

Abstract.

ABSTRACT FROM A REPORT UPON TWENTY-FIVE CASES OF HUMAN ACTINOMYCOSIS, WITH ESPECIAL REFERENCE TO VACCINE THERAPY.*

By LEONARD COLEBROOK, M.B., B.S.Lond.,
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A DISCUSSION OF SOME PROBLEMS CONNECTED WITH THE DISEASE.

IN a previous communication† I have described the mycelial and other micro-organisms met with in investigating a series of cases of human actinomycosis, most of which were under treatment at the

* The complete Report appears in *The Lancet*, 1921, i., 893.
† *British Jour. Exper. Pathology*, 1920, i., 197.

Inoculation Department, St. Mary's Hospital, during the years 1911-15.

In the present communication it is proposed to record what was learned from this series of cases in respect of the diagnosis, the clinical course, and particularly the treatment of the disease ; and subsequently to discuss two questions which arise—viz., What is the source of these infections ? and what restrictions is it advisable to put upon the use of the term actinomycosis ?

Definition.—The cases here dealt with all presented granulomatous lesions from which the so-called " sulphur granules," visible to the naked eye, were forthcoming, and these granules were in every case composed of a feltwork of Gram-staining mycelium. The importance of strictly limiting the use of the terms actinomycosis (and paractinomycosis) to cases of this kind will be discussed later.

Diagnosis.—We have at present no reliable method of detecting an actinomycotic infection in its early stages, *i.e.*, prior to the occurrence of suppuration. The slowly progressive, comparatively painless, and indurated lesion may suggest the diagnosis, but one is at a loss to confirm it by blood examinations, for opsonic estimations will often fail to distinguish between a tuberculous and an actinomycotic infection (the opsonic power to the tubercle bacillus is frequently high in actinomycosis), and agglutination tests with actinomyces, although they will usually give positive results in advanced cases, are apt to be negative in the milder cases. Further observations on this latter point are required.

THE INCIDENCE OF THE DISEASE AND ITS ULTIMATE ISSUE.

There is reason to think that actinomycosis occurs more frequently in this country than is generally supposed. In the cases which end fatally a correct bacteriological diagnosis is often made only when the disease is far advanced, or post-mortem, and it therefore appears probable that a large number of the less severe cases escape recognition

TABLE I.

Site of infection.	No. of cases.	Males.	Females.	Ultimate result.
Face or neck ...	10	7	3	9 recovered completely ; 1 died.*
Thorax	8	5	3	7 died ; 1 lost sight of.
Abdomen	6	1	5	5 died ; 1 recovered.
Dorsum of hand ...	1	1	—	Recovered completely.
Total	25	14	11	—

* Death was due to cerebral abscess, resulting from direct extension of the disease through the skull.

altogether—notably those cases in which the infection is situated about the lower jaw, and possibly also, as Mr. Slesinger* has suggested, some of those in which the vermiform appendix is affected. In Table I the patients observed by the author are divided up according to the site of their infection ; the incidence in the two sexes is also shown, and the ultimate issue of the disease.

Table I confirms the usual experience that (*a*) cervicofacial infections are the most numerous and also the most likely to recover ; (*b*) infections of the thorax and abdomen are usually fatal. The latter conclusion should, perhaps, be stated with some reserve, for the future may show that actinomycotic infections of the vermiform appendix occur much more commonly than has been supposed, and that many such cases are promptly cured by the ordinary operation of appendicectomy. (Slesinger.)

Age of the Cases.—Seventeen of the 28 cases were young adults, seven were older subjects (one of them being 70 years of age), and four were children between the ages of 10 and 13, I have not known the disease to occur below the age of 9.

Duration of the Disease.—The course of these infections was commonly a very slow one. The disease had usually been in progress for several months before the patients came to the hospital for treatment, and although in three of four instances cure was obtained within a few weeks, the larger number of those who recovered were under treatment for a period of months. One case in whom the infection extended widely in the ramus of the mandible was apparently cured after three to four years, but a small focus reappeared in front of the ear and has persisted for a further two years. The fatal cases of thoracic or abdominal infection usually survived from one to two years from the onset of the disease. One abdominal case was terminated abruptly after several weeks in hospital by the development of septic peritonitis.

Treatment.

Most of the cases had been treated by potassium iodide and by incisions before coming to the Inoculation Department at St. Mary's Hospital. The iodide had not usually been pushed beyond 30—40 grs. per diem ; in one or two instances 60—90 grs. had been given. In these doses the drug had not exercised any appreciable effect upon the disease. Its use was usually discontinued soon after the patients came under observation ; in a few instances, however, on the suggestion of the surgeon who was collaborating in the treatment of a patient, the drug was continued and pushed up to 180 grs. or more per diem, but still without effecting any improvement in the patient's condition.

* *Lancet*, 1920, i., 1,220.

It should be acknowledged that the patients so treated were very unfavourable cases.

Upon inquiring into the origin and the general experience of this method of treatment I have failed to find that it has an assured scientific basis, or even a sufficient vindication by results. Introduced empirically by Thomassen* in 1885 for actinomycosis of the tongue in cattle, it was later acclaimed by Nocard† (1893) as an almost infallible remedy for this condition. When it came to be applied to the treatment of other actinomycotic lesions in cattle the results seem to have been less uniformly good, but I understand that it is still regarded by the veterinarians as a specific remedy.

Investigations undertaken with a view to finding an explanation of its reputed specific action have so far been quite unsuccessful.

Speaking generally, the treatment of the patients while under the author's care was (*a*) by surgical measures, and (*b*) by the inoculation of vaccines. The surgical measures taken were usually confined to incisions for the evacuation of pus and curetting. In connection with each of these procedures something was learned from our experience. We learned, in the first place, that a single incision will seldom suffice to maintain satisfactory drainage of an actinomycotic focus. It is characteristic of this infection in man that it spreads by direct extension in contiguous tissues—particularly in the connective tissues—and leads to the formation of small abscess cavities here and there along the line of spread. To check the invasion one must be constantly on the watch for fresh areas of induration and softening, and must resort early to incision of these as often as they appear. My experience leads me to conclude that this policy of early and, if necessary, repeated incisions, is of paramount importance in the treatment of the disease. I think one may go so far as to say that in every focus that is satisfactorily drained the infection by actinomyces will be promptly checked, for this organism, although it can propagate in the fluid of an abscess cavity (which has lost much of its antitryptic power) cannot do so in the unaltered lymph.

This being the case, I would suggest that the principles of treatment advocated by Sir Almroth Wright‡ in connection with wound infections should be employed here, the incisions being followed up by the intermittent application (every two to three hours) of hypertonic salt solution (3 to 5 per cent.) in order to promote a free flow of lymph through, and out of, the infected tissues. This treatment should be discontinued after a few days in order to facilitate healing.

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* *L'Echo Vétérinaire*, 1885.
† *Revue de Méd. Vétérinaire*, 1893.
‡ *Brit. Med. Journal*, 1916, i., 793.

What we learned in connection with curetting was that this operation should not be performed with a sharp instrument—which opens up uninfected tissues—but with a dry gauze swab. There is in actinomycosis a fairly sharp line of demarcation between the uninfected and the infected tissues, and since the latter, in process of erosion, are very friable, it is usually possible to remove them almost *in toto* on a swab, leaving the wound with so little infection that it can easily be dealt with by the leucocytes. In one of the later cases of the series here reported an abscess nearly as large as a closed fist was treated in this way after incision and forthwith sewn up. It healed by first intention in a week.

Treatment by Vaccines.

Up to the present the writer has treated some twenty-three cases by this method, always in association with simple surgical measures, as outlined above. In all cases a vaccine prepared from strains of *Actinomyces bovis* of human origin was employed, and most of them received in addition other vaccines corresponding to their respective secondary infections. Autogenous actinomyces vaccines were used for eleven cases, most of the remainder being treated by the polyvalent stock vaccine prepared at St. Mary's Hospital and issued by Messrs. Parke, Davis & Co.

The Results of Vaccine Treatment.

The inoculated cases comprise :—Eleven cervico-facial infections, with which may be included one of the hand ; six thoracic infections ; six abdominal infections. The first group—of eleven cases—included two which were decidedly unfavourable to any treatment. Nine of them have not, so far as I have been able to ascertain, had any recurrence during the four to six years that have elapsed. In the least extensive cases a period of three to six weeks sufficed for cure, but in others a much longer time was required and many inoculations. Whenever bone was involved the recovery was very slow.

Of the six thoracic cases none have been saved. In considering this melancholy failure it should be made clear that in all of them the disease had made considerable headway before vaccine treatment was instituted.

With regard to the six abdominal cases much the same considerations apply. The five of them who died had been ill for 13, 8, 6, 5, and 5 months respectively before they were transferred to us for treatment.

Conclusions with Regard to Vaccine Treatment.

The opinion I have formed from my experience up to date is as follows :—The treatment of actinomycosis by vaccines facilitates recovery when efficient surgical drainage of the affected tissues is

secured and maintained; when, however, drainage is unsatisfactory the use of appropriate vaccines will not usually suffice to stay the progress of the infection. In three or four of my cases which had hung fire for several weeks or months, improvement took place so promptly and so rapidly after the commencement of inoculations that there seemed to be no doubt as to the efficacy of the treatment, and this opinion found further support from the case of thoracic infection whose story has been told above.

With reference to the failure of vaccine treatment in cases whose lesions are not satisfactorily drained I would suggest that this may be due in a large part to the blood stream having very little access to those lesions by reason of the zone of "wooden" induration which habitually surrounds them.

Discussion.

(1) Concerning the Term Actinomycosis.

There is, unfortunately, a great deal of confusion with regard to the use of this term. In what follows I shall try to show that under it have been included in the past at least four classes of cases. As a consequence our knowledge of these infections has become less, rather than more exact, and progress in the direction of better treatment has been undoubtedly handicapped. The recent application of vaccine therapy to these cases makes it particularly desirable that we should deal, as far as possible, with homogeneous groups of cases, and give to these groups distinguishing names. We may now consider what restrictions it might be well to put upon the term actinomycosis.

The origin of this term dates back to the discovery of the well-known radiating arrangement of "clubs" round the "sulphur granules" derived from certain granulomatous lesions of cattle and of man. So far as was known at that time such granules were always composed of a feltwork of branching mycelium. It is readily understood, then, that the presence of "granules" came to be regarded as diagnostic and pathognomonic of actinomycosis. When, with the introduction of artificial media, cultures were obtained from some of these infections, several quite distinct organisms were reported by different investigators, the types which attracted most attention being (1) an easily grown, arobic variety, described by Bostrôm and others; and (2) an anaerobic variety, grown with difficulty, described by Wolff and Israel. In view of these discordant results of the earlier bacteriological work it came to be believed that there was no one infective agent responsible for actinomycosis, but that several more or less allied micro-organisms could produce the disease.

The work of the past 20 years, however, has brought to light two facts which require us to recast the earlier views. It has shown

(1) that the production of granules with clubs is not pathognomonic of actinomycosis; the same thing occurs in various conditions which are not mycoses at all but bacillary infections, and sometimes is associated with clinical conditions totally different from those of actinomycosis. (2) That of all the human infections which are productive of "granules" and show the well-known clinical features of actinomycosis, the great majority are due to one and the same mycelial species, viz., that described by Wolff and Israel.

Lignières and Spitz* have described an infection of cattle which gives rise to granulomatous tissue not unlike those of actinomycosis, but in which the "sulphur granules" (showing typical clubs) are composed entirely of Gram-negative bacilli. They gave the name "actinobacillose" to this condition and that of "*actinobacille*" to the microbe. These authors state that this infection is widely spread in the world. Nocard† reported cases in France in 1902, and in 1915 Griffith,‡ examining so-called actinomycotic material (chiefly tongues) derived from cattle killed in England, made the important discovery that no less than forty out of forty-four specimens presented lesions which were apparently due to this bacillus and not to a mycotic infection.

Apart from actinobacillosis it is well known that the injection of tubercle bacilli will, in certain circumstances, give rise to club formation around the masses of bacilli. Further, Lignières and Spitz§ state that granules with clubs ("massues rayonnées") may occur in animal infections produced by various other microbes, *e.g.*, by the butter bacillus of Rabinowitsch, the bacillus of Cozzolino,

We may pass now to the statement that the great majority of actinomycotic infections are due to one microbic species, viz., the anaerobic type *Actinomyces bovis*‖ described by Wolff and Israel.** The data relating to that conclusion may conveniently be set out in the form of a table (Table III) showing the more important of the records of bacteriological investigations made during the past 20 years.

It will be seen from Table III that in seven different parts of the world one and the same type of mycelial organism, viz., that described by Wolff and Israel (1891), has played a predominant part in the actinomycotic infections both of man and cattle.

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* *Receuil de Med. Vet.*, 1902, 487.
† *Receuil de Med. Vet.*, 1902, 450 and 695.
‡ *Journal Hygiene*, 1916, xv., 195.
§ *Receuil de Med. Vet.*, 1902, 487.
‖ *Archiv. f. pathol. Anat. u. Physiol* (Virehar), 1891, cxxxvi., 11.
** In adopting the name *Actinomyces bovis* for this type I follow the usage which seems to have the most general support. Some writers, including Lignières and Spitz, have held that the name properly belongs to the quite different aerobic organism described by Boström and others.

TABLE III.

(A) Number of cases from which cultures were obtained and the type of mycelial organism determined.

(B) Number of cases from which *Actinomyces bovis* (Wolff-Israel) was cultivated. It is not claimed that the description given by each investigator for the strains included in this column tallies exactly with that of Wolff and Israel. There is, unfortunately, at present no touchstone by which to decide unequivocally whether a given strain is or is not identical with the type Wolff-Israel. The figures given should, therefore, be taken to mean that each investigator himself regarded so many of his strains as showing a general correspondence with that type.

(C) Number of cases from which an anaerobic mycelial organism quite distinct from *Actinomyces bovis* was cultivated.

(D) Number of cases from which an aerobic mycelial organism was cultivated.

Name of investigator, date of publication, and country in which the cases occurred.	Infections of man.				Infections of cattle.			
	(A)	(B)	(C)	(D)	(A)	(B)	(C)	(D)
Levy (1899), Germany	5	5	0	0	—	—	—	—
Schukevitsch (1903), Russia ...	—	—	—	—	25	22	—	3
Homer Wright (1905), U.S.A. ...	13	13	0	0	2	2	0	0
Shiota (1909), Japan	29	28 (*a*)	—	—	—	—	—	—
Harbitz and Grondahl (1911), Norway	20	20	0	0	—	—	—	—
Pinoy (1913), France	3	2 (*b*)	—	—	16	14	—	2
Colebrook (1920), England	24	21	2 (*c*)	1 (*d*)	—	—	—	—
Totals	94	89	2	1	43	38	0	5

(*a*) The character of the one remaining strain not described.

(*b*) One strain not identified.

(*c*) It is doubtful whether these two strains were really distinct from *Actinomyces bovis* or merely variants of that type. They showed slight differences in respect of their cultural characters, but owing to pressure of other work were not fully investigated.

(*d*) A single colony of the mycelial organism was cultivated from this case.

(2) WHAT IS THE SOURCE OF INFECTION IN ACTINOMYCOSIS?

The answer to this question is given—either definitely stated or implied—in every surgical and veterinary text-book. But is it true? The " ray fungus," we are told, has its habitat in soil, on grain, straws, and other vegetable matter and is conveyed by these to the tissues of man and animals. This belief is chiefly due to the advocacy of Bostróm, who, in 1891, published a report of a laborious investigation on the subject. He observed that cattle grazing in marshy districts frequently developed actinomycosis, and that moulds were met with on the vegetation of such districts, which showed some resemblance to certain mycelial organisms which had occasionally been cultivated from actinomycotic discharges. Further, on examining the mouths of cattle Bostróm noticed that particles of vegetable matter were very frequently forced down between the teeth and gums, and he concluded that these particles probably carried the infection into the tissues. By means of serial sections he succeeded in demonstrating minute fragments of vegetable matter (barley " whiskers ")

in several instances, and he reports in detail the case of a woman who developed a submaxillary abscess, in the pus of which a similar tiny particle of barley (1×0.2 mm.) was detected.

This chain of evidence is not, however, very satisfactory when looked at from the standpoint of to-day. We now know, as has been shown above, that an anaerobic species (*Actinomyces bovis*), and not the organism described by Boström, is most commonly the infecting agent in actinomycosis, of man at any rate. Secondly, *Actinomyces bovis* has never, so far as I am able to ascertain, been met with outside the animal body. There are many species of actinomycetes recoverable from soil, but all appear to be aerobic organisms with characters quite different from those of *Actinomyces bovis*. Harbitz reports an attempt of Hagen to recover the latter organism from "natural" sources in a part of Norway where actinomycosis was fairly common. He investigated nine strains of mycelial organisms (three obtained from the air, two from straw, three from barley and oats, and one from manure), but all were compulsory aerobes. Thirdly, *Actinomyces bovis* is a very delicate organism, which grows only at temperatures near that of the human body and very sparsely, if at all, in the presence of air; it also dies out very readily, especially when dried, and has not been shown to form spores. Having these characters, there is little likelihood that it has its "natural" habitat outside the human and animal body. Again, it is, perhaps, significant that the incidence of actinomycosis seems to be no greater among the agricultural population than among town-dwellers; and women are affected almost as frequently as men. Finally, it may be remarked that only in a very small percentage of cases is there any record of a vegetable foreign body having been evacuated from the primary abscess or a history which suggests the probability of this mode of infection. Only one of the author's twenty-five cases had such a history.

In view of all the above considerations it seems highly improbable that infection is usually conveyed to man in the manner suggested by Boström. At the same time one must acknowledge that there are a fair number of well-attested cases on record in which infection seems definitely to have followed the impaction of vegetable material.

Translation.

INTOXICATION BY YOUNG SHOOTS OF RHODODENDRON.

By M. ROSSIGNOL,
Pupil at the Alfort School.

On the evening of February 10 M.C., under-gardener in one of the large Parisian gardens, gave, as green food in the ration for his three goats, a handful (about 800 grammes) of young shoots of Rhodo-

dendron Ponticum, which had been cut the same day. Next morning he found his animals stiff in their limbs, dejected, holding the head low, bleating plaintively, grinding the teeth, and a greenish saliva escaping in long threads from the labial commissures, whilst the litter and sides of the box, up to the height of the animals, was soiled with vomit that had been forcibly expelled.

In the litter M.C. found a good half-handful of shoots, and a number of rhododendron leaves, which had been expelled intact. The three subjects showed loss of appetite, constipation shown by fruitless expulsive efforts, and received 100 grammes each of warm castor oil. In the course of the day the animals received besides some tea, linseed mucilage, and bicarbonate of soda.

Towards the evening one of patients (five years old), which had never lain down, fell as if paralysed, vomited for the last time, and died.

A second subject (seven years old) kept lying down and getting up with difficulty all day on February 12, showed general tremors and true tetanic spasms, and died on the morning of the 13th.

The third subject (three years old), whose symptoms of poisoning were less accentuated, received warm milk with bicarbonate of soda, and eight to ten times daily abundant (two to four quarts) injections of warm water. On the 14th the animal vomited once, constipation declined, stiffness disappeared gradually, and on the 18th he was put on normal diet.

Most of these symptoms coincide with Cornevin's description of rhododendron poisoning, but constipation was one of the symptoms that struck the owner most, whilst Cornevin gives intense diarrhœa. Further toxic symptoms do not seem to be eliminated as quickly as Cornevin indicates, since the subject surviving was not out of danger until the end of the fourth day. Finally, from observation after the accident, a relatively small dose of the leaves (200 grammes per animal as a maximum) can lead to a fatal issue.

Personal.

Our colleague, Dr. H. B. Elliott, M.R.C.V.S., appears to have "made good" in Hawaii, as at a meeting of the principal citizens of Hilo this gentleman was elected chairman of the First Civic Convention, of which he was practically the founder. Through his energies an inter-island Council has been formed to deal with questions of citizenship, the language to be taught in the schools, matters affecting commerce, and other things of vital importance affecting the prosperity of these "go-ahead" little islands which form so prosperous a portion of the United States of America.

After graduating from the New Veterinary College in 1894, Mr. Elliott practised for some time at Ayr, relinquishing this to go to America, where he eventually settled down as Territorial Veterinarian at Hilo, Hawaii. His genial manner and professional skill speedily brought him a first-class *clientèle*, and he has held many civic positions which have justified the confidence of his fellow citizens.

NOTICES.

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